RETURN TO
MR THORNE
G.S.D.D.

TF 2100

A.F. Oscillator

PERATING INSTRUCTIONS

MARCONI INSTRUMENTS LIMITED
ST. ALBANS HERTFORDSHIRE ENGLAND

Accessories supplied for TF.2100

Coaxial free plug Type MIP.44602
Stocklist item No.21

HANDBOOK CHANGE

for

A.F. Oscillator TF 2100

ERROR : On p. 22, 2nd paragraph, the potential of +55 V should be measured at tag 12 relative to tag 9.

CHANGES : On circuit diagram Fig. 4.4 and components list alterations to component valves have been made.

R13 from 47 kΩ to 100 Ω
R18 from 1 kΩ to 2.2 kΩ
R24 from 1 kΩ to 100 Ω
R28 from 1 kΩ to 100 Ω
R46 from 100 Ω to 10 Ω

M.I. Ltd.

OPERATING INSTRUCTIONS
No. EB 2100

for

A.F. Oscillator

TF 2100

Copyright © 1963

MARCONI INSTRUMENTS LIMITED
ST. ALBANS HERTFORDSHIRE ENGLAND

C. P. 4c
5/63/A

EB 2100
1 - 5/63

CONTENTS

Section		Page
1	GENERAL INFORMATION	3
1.1	Introduction	3
1.2	Data Summary	4
1.3	Associated Equipment & Accessories Available	5
2	OPERATION	7
2.1	Controls and Connectors	8
2.2	Preparing for Use	8
2.3	Setting Frequency	9
2.4	Output	11
2.5	Mounting in Case TM 7010	12
3	CIRCUIT SUMMARY	14
3.1	Amplifier and Output Control	14
3.2	Feedback	15
3.3	Power Supply Circuits	16
4	MAINTENANCE NOTES	17
4.1	General	17
4.2	Fuses	17
4.3	Access to Components	17
4.4	Mains Transformer Connections	19
4.5	Semiconductors	19
4.6	Working Voltages	21
4.7	Presets	22
	COMPONENT LIST	25
	CIRCUIT DIAGRAM	
	Fig. 4.4 A.F. Oscillator	33

I GENERAL INFORMATION

1.1 INTRODUCTION

A.F. Oscillator Type TF 2100 is a low distortion RC oscillator for audio frequency measurements in the range 20 c/s to 20 kc/s. This frequency range is covered in six bands, and there is an uncalibrated fine frequency control. The instrument will provide +15 dBm (31.6 mW) to a 600 Ω unbalanced load, and up to 8.5 V or more when the load impedance is high. The output is available at front panel terminals and is fed to these via a continuously variable 600 Ω attenuator having an uncalibrated range of more than 40 dB. Compactness has resulted from the use of transistors throughout. The power supply circuit permits operation from either a.c. mains or a d.c. source.

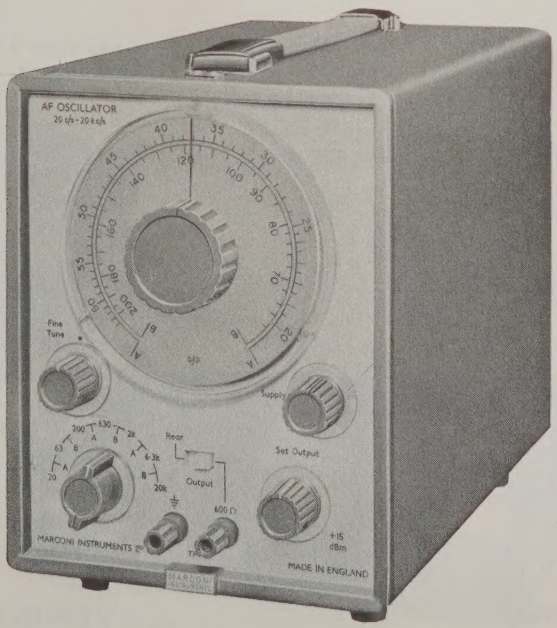


Fig. 1.1
A.F. Oscillator
Type TF 2100

1.2 DATA SUMMARY

Frequency	
Range :	20 c/s to 20 kc/s, in six bands. Auxiliary fine control.
Accuracy :	±1% ±0.2 c/s.
Output	
Power :	+15 dBm (31.6 mW) into 600 Ω; over 8.5 V open circuit.
Control :	At least 40 dB range of attenuation, by continuously variable T-network.
Impedance :	600 Ω ±20% unbalanced.
Frequency Response :	Over the frequency range, the change in output level is less than ±0.4 dB.
Distortion :	Less than 0.05% from 63 c/s to 6.3 kc/s; less than 0.1% from 20 c/s to 20 kc/s.
Hum :	Less than 0.01% (-80 dB) of output signal, or -100 dBm, whichever is the greater.
Power Supply :	190 to 260 V and 95 to 130 V, 45 to 500 c/s, 7 W. Also 210 to 260 V and 105 to 130 V, 500 to 1000 c/s, 7 W. Or, after resetting rear panel switch, 65 to 90 V d.c. floating, 60 mA.

Dimensions :	Height	Width	Depth
	7 3/4 in (19.5 cm)	5 3/4 in (14.5 cm)	10 1/2 in (27 cm)

Weight : 8 1/2 lb (3.75 kg)

Accessories Supplied

One coaxial free plug, Belling Lee List No. L1465/FP/Ag.

Accessories Available

(a) Modular rack mounting case Type TM 7010.

(b) Blank Panel Unit Type TM 6844.

(c) Shielded adaptor Type TB 39868 (Greenpar Type GE51002).

1.3 ASSOCIATED EQUIPMENT AND ACCESSORIES AVAILABLE

The A.F. Oscillator TF 2100 belongs to a series of instruments designed in the same size or multiples of this size (the width varying). To enable these units to be mounted together in a standard 19 inch rack, case Type TM 7010 is available. The TF 2100 and two other units of the same size (or one other unit twice the width of the TF 2100) can be fitted in line in this case, which has slotted brackets at each end for rack fixing. Unoccupied spaces in the case can be filled by one or more Blank Panel Units Type TM 6844, each being 1/3 of the width of the case.

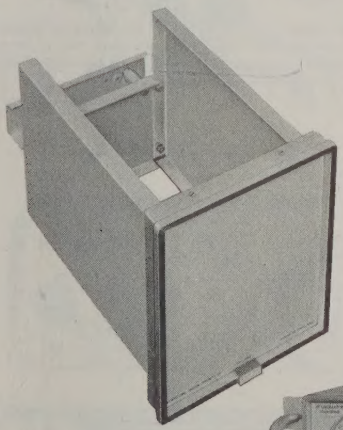


Fig. 1.2
Blank Panel Unit
Type TM 6844

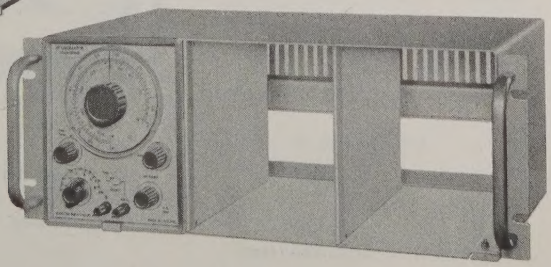
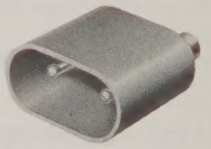


Fig. 1.3
Rack mounting case
Type TM 7010
with one compartment
occupied

Three instruments that may singly be used with the TF 2100, and which belong to the same series, are A.F. Monitored Attenuator TF 2160, M.F. Attenuator TF 2162, and M.F. Monitored Attenuator TF 2161. Each has the same dimensions as the TF 2100, and can be mounted in another compartment beside the TF 2100 in a TM 7010 case. When one of the Attenuators and the TF 2100 are together in the case, it is easy to link the two between their rear panels; in these circumstances, in addition to the signal, the TF 2100 can supply the d.c. requirements of a TF 2160 or TF 2161, which otherwise use batteries.

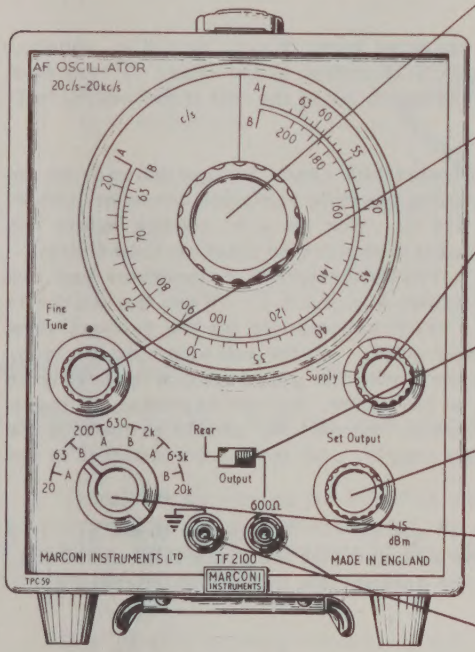
Fig. 1.4 Shielded Adaptor Type TB 39868

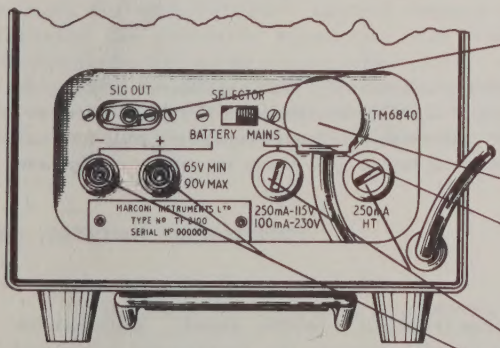


Also available is a shielded adaptor, Type TB 39868 (Greenpar Type GE51002), which can be plugged onto the output terminals of an A.F. Oscillator to convert them into effectively a BNC coaxial socket outlet.

2 OPERATION

2.1 CONTROLS AND CONNECTORS





Frequency control and dial : use outer scale (A) or inner scale (B) according to setting of frequency band switch

FINE TUNE : fine frequency adjustment

SUPPLY switch : turn clockwise to switch on

Switch to right for front output, to left for rear output

SET OUTPUT : level control

Frequency band switch

Output terminals

SIG OUT socket : alternative rear outlet (Belling-Lee miniature)

A.C. supply inlet

SELECTOR switch : set to right if supply is a.c., to left if supply is d.c.

Fuses

D.C. supply input terminals

Not shown :
Concealed by the rear cover is a twin socket, H.T. OUT, which can be used to feed a TF 2160 A.F. Monitored Attenuator.

Fig. 2.1
Controls and Connectors

2.2 PREPARING FOR USE

POWER SUPPLY

The A.F. Oscillator can be operated from an a.c. or a d.c. source, according to the setting of the SELECTOR switch at the rear. Press this to the right if an a.c. source will be used, or to the left if the source will be d.c.

Normally the instrument is despatched ready for operation from an a.c. source having a voltage (including possible variation above or below nominal value) in the range 190 to 260 V. For an a.c. voltage within the limits 95 to 130 V, the tags on the mains transformer must be linked differently and the input fuse changed. The transformer connections and the fuses required are described in Sections 4.4 and 4.2. When the source is a.c., be sure that the instrument is ready accordingly for the voltage, then connect the mains lead to the supply point. At the end of the mains lead, the conductor carrying the yellow sleeve with the green symbol must only be connected to 'earth' ('ground'). It is advisable, but not essential, to make this connection. The black conductor, marked N, should preferably be connected to the neutral side of the supply, and the third conductor to the 'line' or 'phase' side.

A d.c. source can be between 65 and 90 V. It must be floating. Dry batteries can be used, but it should be noted that the drain is about 60 mA. Connect leads from the source to the appropriate terminals, marked + and -, at the rear.

PRECAUTIONS AGAINST HEAT

Employing transistors (some germanium), the instrument is accordingly susceptible to abnormal heat. Completely remove the plastic cover, if one is supplied over the case. Although the instrument is small and can be positioned easily, do not place it on top of, or close to, other equipment that may overheat it.

OPERATING POSITION

Underneath the case, near the front, is a folding stand. This can be pulled down and forward so that it will support the instrument in a tilted position on a bench; see Fig. 2.2. Having the front panel facing upwards in this manner can make operation easier in some circumstances.

For details regarding fitting the instrument with others in a rack mounting case TM 7010, see Section 2.5.

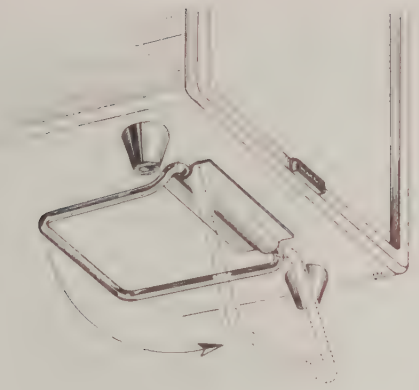


Fig. 2.2
Lowering Stand

SWITCHING ON

CAUTION - Be sure that the instrument is set correctly for the supply source.

Switch on by turning the SUPPLY switch clockwise. The instrument is ready for use almost immediately; the time taken to reach a high degree of stability depends on the setting of the frequency band switch, but is normally less than $\frac{1}{2}$ minute.

If a load is already connected, and is sensitive, it may be advisable to turn the SET OUTPUT control counter-clockwise before switching on. Initially, the generated signal may rise to approximately 50% above normal amplitude before stabilization takes place. Also - when the load impedance is high and the SET OUTPUT control is fully clockwise - a d.c. pulse of several volts appears briefly when the instrument is switched on and switched off, the pulse being positive and negative respectively.

2.3 SETTING FREQUENCY

To set the A.F. Oscillator to a particular frequency :-

(1) Set the frequency band switch to a range that embraces the required frequency. On the front panel, each position of the frequency band switch falls between two figures, which indicate in c/s the frequency limits of the band obtained at that position. Each position is also marked with a letter, A or B, indicating whether scale A or B must be read on the frequency dial.

(2) Turn the frequency control so that the dial indicates the required frequency, reading scale A or B depending on the setting of the frequency band switch; it will be found that the figures on this scale are either direct-reading or need only be multiplied by 10 or 100, according to the band selected.

(3) Set the FINE TUNE control to the mark on the panel (i.e. the centre of its range of adjustment).

Example : To obtain a frequency of 4 kc/s.

Set the frequency band switch to the position between 2 k and 6.3 k. This position is marked A. Turn the frequency dial so that it reads 40 on scale A. Set the FINE TUNE control to its reference mark. See Fig. 2.3.

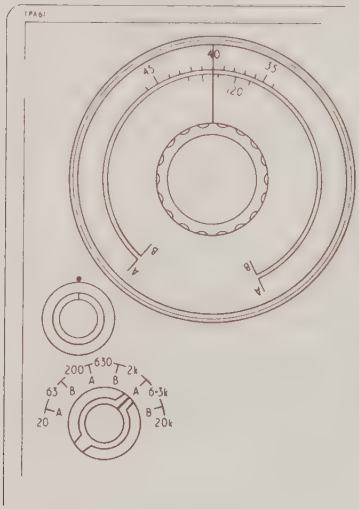


Fig. 2.3
Frequency controls set for 4 kc/s

Because of the use of transistors, the tuning elements in the Oscillator are variable resistors. These are ganged and are of a wire-wound type, giving the greatest accuracy of calibration. But it should be noted that, as a result of the moving contacts passing over the discrete turns of wire in these components, some fluctuation of output may be experienced during tuning. Stabilization at the original output level takes place after any adjustment.

The FINE TUNE controls allows gradual and precise frequency adjustment over a limited range in the region of the setting of the main frequency control. It can be used to minimize the frequency calibration error of the main dial at a particular frequency and in its vicinity; by adjusting the FINE TUNE control, the reading of the main dial can be standardized against the indication of a counter connected to the output. The FINE TUNE control also facilitates setting the instrument exactly to the optimum pass or rejection frequency of a highly selective circuit, such as a filter having a narrow frequency response.

2.4 OUTPUT

Before connecting a sensitive load to the instrument, turn the SET OUTPUT control fully counter-clockwise to avoid applying too much output.

Output from the A.F. Oscillator can be taken from the front panel terminals, or from the Belling Lee miniature coaxial socket, SIG OUT, at the rear, depending on the setting of the switch above the terminals on the front panel. Set this to the right for front terminals output, or to the left for use of the rear coaxial socket. The front terminals contain sockets for 4 mm plugs and will accept a twin plug having 3/4 inch spacing.

CAUTION : The 'live' front panel terminals, or the centre socket of the rear coaxial outlet, is fed internally through a reversible electrolytic capacitor. Damage may result if the load applies more than ±25 V d.c. back to the instrument.

From the fully counter-clockwise position, turn the SET OUTPUT control clockwise, raising the output, until the required level is obtained. When the control has been rotated through a small angle from the extreme counter-clockwise position, it enters upon an approximately linear range of at least 40 dB adjustment. Maximum output, when the control is fully clockwise, is at least +15 dBm into a 600 Ω load, or up to more than 8.5 V across a high impedance load.

The source impedance is 600 Ω, unbalanced, at either the front panel terminals or the rear coaxial outlet. The accuracy of this value of impedance is particularly good at maximum output, when the SET OUTPUT control is fully clockwise.

To obtain good shielding and facilitate employing coaxial cable leads, the use of an adaptor TB 39868 (an optional accessory) is recommended This, in effect, converts the output terminals into a BNC socket.

2.5 MOUNTING IN CASE TM 7010

FITTING PROCEDURE

To fit an A.F. Oscillator in a rack-mounting case Type TM 7010, proceed as follows :-

(1) Remove the instrument from its case; see Section 4.3.

(2) Fit the rear cover of the rack-mounting case into the channels provided at the rear edge of the case. The large aperture should be lower than the ventilating slots. (The bottom of the case is the separate panel assembled to the rest).

(3) Select the compartment to be occupied by the A.F. Oscillator (removable divisions separate the case into three sections) and slide the unit in backwards, keeping the rear end up to avoid the screws in the bottom of the case.

(4) Insert the two coin-slotted screws, originally in the case of the A.F. Oscillator, through the appropriate holes in the rear cover of the rack-mounting case, and tighten them to the bar at the rear of the A.F. Oscillator.

To free the mains lead held in the rear cover taken off the A.F. Oscillator, press down with pliers the smaller of the two plastic pieces making up the bush through the cover, and push the bush assembly and lead through the hole. Alternatively, the socket can be removed from the mains lead and used in making up a suitable lead for the instrument when mounting in a rack.

LINKING TO AN ATTENUATOR

The subsidiary coaxial outlet at the rear of the A.F. Oscillator can conveniently be linked to the coaxial inlet at the rear of a A.F. Monitored Attenuator TF 2160, a M.F. Monitored Attenuator TF 2161, or a M.F. Attenuator TF 2162. The Belling Lee miniature coaxial sockets are accessible through the aperture in the rear cover of the case TM 7010. A coaxial lead for this purpose is available as an optional accessory with the Attenuators.

It is also possible to provide the d.c. requirements to the monitor circuit in the TF 2160 or TF 2161 from the TF 2100 when either Attenuator and the Oscillator are together in a case TM 7010. To do this, insert both

units in the case, the Attenuator on the right-hand side of the Oscillator, with the rear cover of the case off. Remove the batteries from the rear of the Attenuator. Remove the battery supply plug from the twin socket on the rear of the Attenuator and link this socket instead with the HT OUT socket on the rear of the A.F. Oscillator; a lead for this purpose is also available as an optional accessory with the Attenuators TF 2160 and TF 2161. Fit the rear cover of the case and secure the units as described above.

3 CIRCUIT SUMMARY

Basically, the A.F. Oscillator consists of a multistage transistor amplifier, two overall feedback loops creating and stabilizing oscillation, and an attenuator controlling the output. The circuit arrangement is shown in the block diagram, Fig. 3.1. The instrument also contains power supply circuits.

3.1 AMPLIFIER AND OUTPUT CONTROL

The first stage of the amplifier employs transistor VT5 in a common-collector or emitter-follower circuit. This is a current amplifier taking as input the net signal derived from the two feedback paths. The transistor used here is a silicon n-p-n type, as are all the others in the amplifier.

The voltage gain in the system is provided by the second stage, VT6. In this, a common-emitter circuit produces high gain as a result of a high effective a.c. collector load impedance obtained by a bootstrap arrangement; the collector load resistor is not fed directly from the d.c. supply but via the emitter of an auxiliary transistor, VT7, driven from a further point in the amplifier chain.

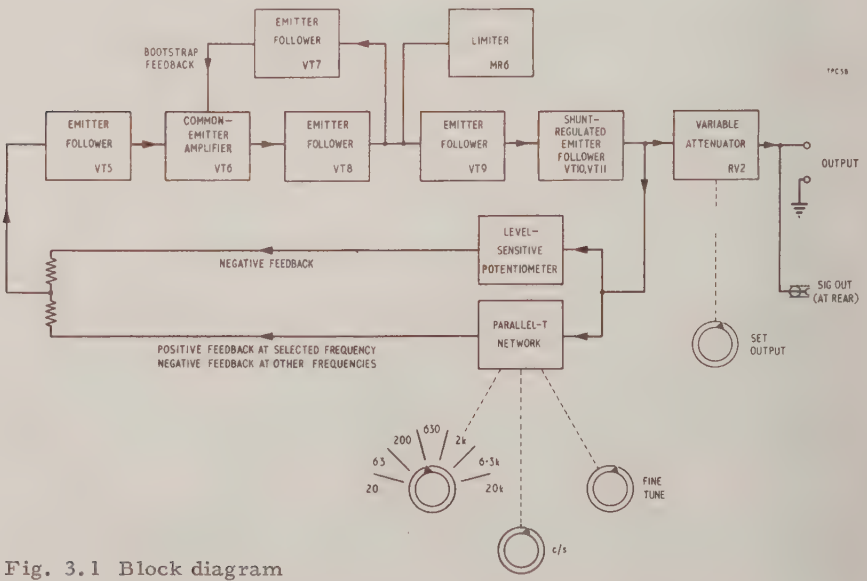


Fig. 3.1 Block diagram

Two successive emitter-followers, VT8 and VT9, amplify the signal current. At the output of the first, the auxiliary transistor VT7 receives its drive; and also at this point diode limiter MR6 is connected, to control the amplitude of initial oscillations at switch-on. The second emitter-follower, VT9, drives the output stage.

In the final stage, a low source impedance and low distortion output are provided by a shunt-regulated emitter-follower, VT10 and VT11. The two paths of a.c. feedback derive their signals from the output of this stage. Beyond, the low output impedance is padded up by resistance to present a constant and suitable value of source for the output level control circuit The output stage has its working conditions stabilized by d.c. negative feedback, returned from it to the first transistor of the amplifier, all the transistors being d.c. coupled.

The output level of the A.F. Oscillator is determined by a 600 Ω T-network attenuator connected to the front panel terminals and also to a rear coaxial outlet, SKT2. This is a continuously variable control, uncalibrated. The rear outlet is intended to facilitate linking to associated equipment, particularly Monitored A.F. Attenuator Type TF 2160.

3.2 FEEDBACK

Two a.c. feedback paths exist between the output of the final stage and the input of the first stage of the amplifier.

One of these determines the frequency of oscillation by providing positive feedback at a chosen frequency through a variable parallel-T network. This network has continuously variable resistors RV6a to RV6c which are ganged together and form a tuning control over a frequency band, and switched capacitors, C17 to C29, enabling a series of six bands to be covered. At frequencies above and below the chosen frequency phase changes in the network cause the feedback to be negative; this provides a considerable measure of harmonic distortion suppression.

The other a.c. feedback path conveys negatige feedback at all frequencies. At the selected frequency of oscillation it is overcome by the positive feedback at the junction where the two feedback paths enter the amplifier. This wide-band negative feedback is derived from two successive resistive potentiometers at the output of the amplifier. In the first potentiometer, thermistor TH1 occupying the upper arm is sensitive to the level of output and varies its resistance, and therefore varies the negative feedback, so that the level of output is stabilized, and also so that the strength of oscillation is always moderate (and therefore generates a minimum of distortion). In the second potentiometer, a physically larger thermistor, TH2, in the lower arm is primarily sensitive to ambient temperature and compensates for the effect of this on the first thermistor.

3.3 POWER SUPPLY CIRCUITS

The A.F. Oscillator has a mains transformer and a full-wave rectifier circuit, feeding the instrument through a series regulating circuit employing p-n-p transistors, VT1 to VT4.

On the mains transformer, T1, are two primary windings, which can be linked in series or parallel to permit operation from a.c. supplies giving between 190 and 260 V or between 95 and 130 V respectively.

Terminals and switch S2 at the rear allow the input of the regulating circuit to be fed from an external d.c. source. A series semiconductor diode, MR1, protects the instrument against the application of the wrong polarity.

4 MAINTENANCE NOTES

4.1 GENERAL

This part of the handbook is intended to provide guidance where it is most likely to be needed in servicing the instrument. In cases of difficulty that cannot be resolved with the aid of this book, or for general advice on maintaining the instrument, please write or phone our Service Division, or nearest Area Office or Agent. (Always mention the type number and serial number of your instrument. For addresses, see rear cover.)

4.2 FUSES

The circuits of the A.F. Oscillator are protected by two fuses : FS1, in series with one supply input connection to the mains transformer; and FS2, in series with the centre tap of the secondary of the mains transformer or in series with the positive input from a battery, depending on the setting of the supply SELECTOR switch, S2.

The fuse holders are accessible at the rear of the A.F. Oscillator. The holder for FS1 is marked 250 mA - 115 V and 100 mA - 230 V; the marked voltages are representative of the overall ranges 90 to 130 V and 190 to 260 V, for which 250 mA and 100 mA fuses should be fitted respectively. The holder of FS2 is marked 250 mA HT.

Replacement fuse links should be 20 x 5 mm cartridges of the quick acting, low breaking capacity type (in accordance with Sheet II of International Electrotechnical Commission Publication 127).

4.3 ACCESS TO COMPONENTS

REMOVING CASE

To remove the case of the A.F. Oscillator :

(1) Withdraw the two coin-slotted screws from the rear of the A.F. Oscillator. Disconnect the mains lead socket from the rear inner panel, Remove the rear cover with the mains lead captive, if the rear cover is loose.

(2) Slide the A.F. Oscillator chassis forward from the case. Alternatively, the front panel can be rested face downwards on a soft surface and the case lifted off.

OPENING CHASSIS

The chassis of the A.F. Oscillator consists of the front panel and three other sections hinged to it. The four sections are normally arranged in the form of a rectangle when viewed from above, and are held in this position by screws. The four sections can be hinged open as follows (see Fig. 4.1) :

(1) Underneath, near the rear, slacken the two 6 BA screws in slots, one at each side of the web that spans the chassis.

(2) Slacken the two relatively large screws at the left-hand side of the rear section until the shoulders under the heads of the screws are clear of the slots through which the screws pass. It should then be possible to separate the chassis at this corner, so that the sections can be hinged open.

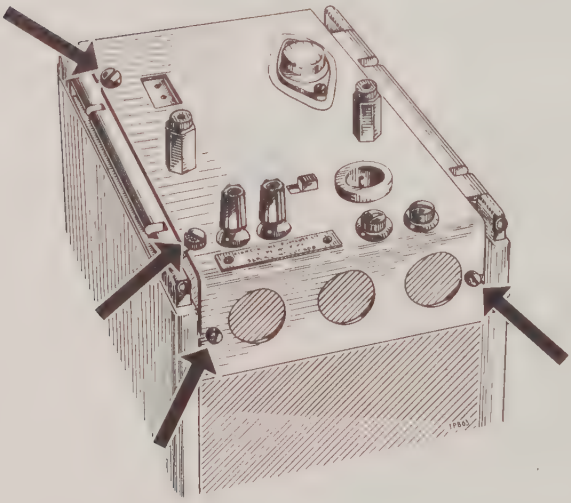


Fig. 4.1

To open chassis, slacken these screws

PRINTED WIRING BOARDS

A printed board is framed in each of the two longer sections of the chassis. The wiring sides are facing outwards.

Each board is held in its frame by plastic clips. Press these to release the board, having disconnected such leads as necessary.

4.4 MAINS TRANSFORMER CONNECTIONS

To examine the connections to the two primaries of the mains transformer, remove the case. To make adjustments to the soldered connections, it is also necessary to hinge open the chassis, see Section 4.3.

If the a.c. supply voltage will lie between 190 V and 260 V, the two primaries must be in series and have a link between the finish F of one and the start S of the other. The a.c. input must be applied to the other F and S terminals. These connections are shown in Fig. 4.2.

If the a.c. supply voltage will lie between 95 V and 130 V, the two primaries must be in parallel and have a link between the two terminals marked S and a second link between the two terminals marked F. The a.c. input must be applied to one S terminal and one F terminal. These connections are shown in Fig. 4.3.

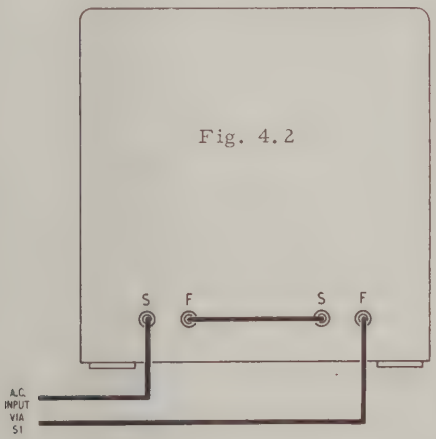


Fig. 4.2

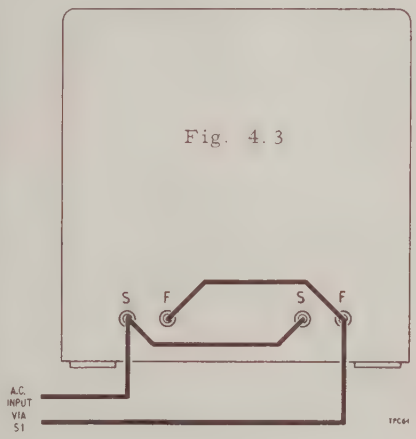


Fig. 4.3

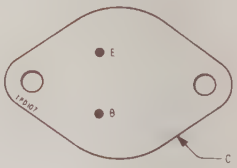
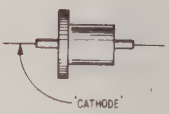
Transformer primary connections for

190 - 260 V 95 - 130 V

4.5 SEMICONDUCTORS

Table 4.1 shows the circuit reference numbers, type numbers, and connection diagrams of the transistors and semiconductor diodes used in the instrument. Some alternative types are also given, particularly those which may be fitted when the instrument is supplied.

TABLE 4.1

Circuit Ref. No.	Type	Alternatives	Connection Diagram
VT1 VT2 VT3	GET111		
VT4	2N1531	OC36 NKT403 2N458	
VT5	2S703		
VT6 VT7 VT8	2S104		
VT9	2S103		
VT10 VT11	2N696		
MR1 MR7	1N540	VA724 SJ402F DD226 40AS 1S103	
MR2 MR3	DD058		
MR4 MR5	Z18(±5%)		
MR6 MR8	1N63	OA95 HG1005 1G26	

4.6 WORKING VOLTAGES

The voltage given in Tables 4.2 and 4.3 are representative of those to be expected on an a.c. operated A.F. Oscillator if measurements are made with a multi-range meter having a sensitivity of 20 kΩ per volt (e.g., an Avometer 8), using the lowest range suitable for each reading. When checking these voltages, allowance should be made for permissible variations in semiconductor performance and component values which may be found on an individual instrument.

It is assumed that the stabilized d.c. supply voltage is correctly set at 55 V; see Section 4.7.

TABLE 4.2.

Power supply circuit voltage relative to positive d.c. supply line (tag 12 on amplifier board)

Transistor	Emitter	Base	Collector	See Note
VT1	-36	-36	-56	
VT2	-56	-56	-87	A
VT3	-56	-56	-87	A
VT4	-56	-56	-87	A

At each tag '3' on transformer T1 : 80 V a.c. See note A.

NOTE A : the voltages at the collectors of VT2, VT3, and VT4, and on T1, are dependent on the a.c. supply voltage. The values given are those to be expected if the value of the supply voltage is the mean of the range for which the instrument is set.

TABLE 4.3.

Amplifier transistor voltages relative to negative d.c. regulated supply line (tag 9 on amplifier board)

Transistor	Emitter	Base	Collector	See Note
VT5	2	2.6	17	
VT6	2	2.2	29	
VT7	33.5	35	55	
VT8	28.8	29.2	55	
VT9	28	28.6	55	
VT10	27.5	28	53.2	B
VT11	1.9	2.4	26.7	

NOTE B : Emitter voltage of VT10 is set by RV4; see Section 3.7.

4.7 PRESETS

Although small adjustments can be made to any of the presets RV1 and RV3 - RV5 alone, it is preferable to check and, if necessary, adjust them all in the following order, RV1, RV4, RV3 and RV5.

RESISTOR RV1

This control determines the voltage of the stabilized d.c. supply feeding the amplifier. The potential should be +55 V at tag 9, relative to tag 12, on the component side of the right-hand printed board.

It is probable that readjustment will be necessary if any of the transistors VT1 to VT4 are changed.

RESISTOR RV3

This sets the gain of the amplifier. The gain should be 400 between test points TP1 and TP2, on the right-hand printed board, measured as follows :-

(1) Disconnect the post.

(1) Disconnect the positive feedback at tag 11 on the component side of the board.

(2) Apply 25 mV at 1 kc/s from a 600 Ω source to TP1 on the wiring side of the board, using tag 21 on the component side as earth.

(3) Read the output on a valve voltmeter connected to TP2 on the wiring side of the board, using tag 21 as earth. Adjust RV3, if necessary, to obtain 10 V r.m.s.

RV3 may require readjustment if any of the transistors VT5 to VT11 are changed, particularly VT6.

RESISTOR RV4

Distortion in the output can be minimized by means of this control. It also varies the positive d.c. voltage at test point TP2 on the wiring side of the right-hand printed board, relative to tag 9 on the component side. This voltage must lie in the range 26 V to 29 V when RV4 is set.

Changing any of the transistors VT5 to VT11 may make readjustment of RV4 necessary.

RESISTOR RV5

Variable resistor RV5, forming part of the level-sensitive potentiometer network, is a means of setting the negative feedback providing level stabilization. To do this :

(1) Set the instrument so that it is oscillating normally at 1 kc/s.

(2) Check the voltage at test point TP2 on the wiring side of the right-hand printed board, relative to tag 21 on the component side, using a valve voltmeter. It should be 11 V r.m.s. Adjust RV5 if necessary. RV5 may need readjustment if thermistor TH1 or TH2 is changed.

RESISTORS RV8-RV19

These set the limits of the frequency bands. Normally, they should not be moved.

Component Ref.	Description	Works Ref.
	CAPACITORS	
C1	.001 µF ±20%, 300 V a.c.	55-TM6840
C2	100 µF +50 -20%, 150 V	20-TM6873
C3	.1 µF ±20%, 150 V	21-TM6873
C4	5 µF +100 -20%, 70 V	22-TM6873
C5	100 µF +50 -20%, 150 V	20-TM6873
C6	5 µF +100 -20%, 50 V	28-TM6879
C7	.01 µF ±20%, 400 V	36-TM6879
C8	50 µF +100 -20%, 12 V	30-TM6879
C9	25 µF +100 -20%, 25 V	31-TM6879
C10	5 µF +100 -20%, 50 V	28-TM6879
C11	10 pF ±0.5 pF, 750 V	29-TM6879
C12	100 µF +50 -20%, 150 V	32-TM6879
C13	220 pF ±20%, 600 V	57-TM6840
C14	100 µF +100 -20%, 50 V	34-TM 6879
C15	1000 µF +50 -20%, 6 V	33-TM6879
C16	100 µF +100 -20%, 25 V Reversal	56-TM6840
C17A	1.771 µF total ±1%, 50 V (Matched Set)	7-TM6880
C17B		7-TM6880
C17C		7-TM6880
C17D		7-TM6880
C18	.56 µF ±1%, 50 V	10-TM6880
C19	.1771 µF ±1%, 50 V	11-TM6880
C20	.056 µF ±1%, 50 V	12-TM6880
C21	.01771 µF ±1%, 50 V	13-TM7057
C22	5600 pF ±1%, 50 V	14-TM7057
C23	1750 pF ±1%, 125 V	15-TM7057
C24	1750 pF ±1%, 125 V	15-TM7057

Component Ref.	Description	Works Ref.
	CAPACITORS (continued)	
C25	5600 pF ±1%, 50 V	14-TM7057
C26	.01771 µF ±1%, 50 V	13-TM7057
C27	.056 µF ±1%, 50 V	12-TM6880
C28	.1771 µF ±1%, 50 V	11-TM6880
C29	.56 µF ±1%, 50 V	10-TM6880
	FUSES	
FS1	100 mA or 250 mA	71-TM6840
FS2	250 mA	72-TM6840
	SEMICONDUCTOR DIODES	
MR1	1N540	61-TM6840
MR2	DDO 58	27-TM6873
MR3	DDO 58	27-TM6873
MR4	Z18 ±5%	28-TM6873
MR5	Z18 ±5%	28-TM6873
MR6	1N63	46-TM6879
MR7	1N540	47-TM6879
MR8	1N63	46-TM6879
	PLUGS	
PL1	MAINS, 3-pin	67-TM6840

Component Ref.	Description	Works Ref.
	RESISTORS	
R1	33 kΩ ±10%, 1/2 W	2-TM6873
R2	820 kΩ ±10%, 1/2 W	3-TM6873
R3	470 Ω ±10%, 1/2 W	4-TM6873
R4	10 Ω ±10%, 1/2 W	5-TM6873
R5	22 kΩ ±10%, 1/2 W	6-TM6873
R6	10 Ω ±10%, 1/2 W	5-TM6873
R7	4.7 kΩ ±10%, 1/2 W	7-TM6873
R8	22 Ω ±10%, 1/2 W	8-TM 6873
R9	10 kΩ ±10%, 1/2 W	9-TM6873
R10	3.3 kΩ ±10%, 1/2 W	10-TM6873
R11	11.75 kΩ ±1%, 1/4 W	11-TM6873
R12	4 kΩ ±1%, 1/4 W	12-TM6873
R13	47 kΩ ±10%, 1/2 W	3-TM6879
R14	6.8 kΩ ±7% TE, 3/8 W	15-TM6879
R15	33 kΩ ±7% TE, 3/8 W	16-TM6879
R16	10 kΩ ±7% TE, 3/8 W	47-TM6840
R17	22 kΩ ±10%, 1/2 W	4-TM6879
R18	1 kΩ ±10%, 1/2 W	5-TM6879
R19	10 kΩ ±10%, 1/2 W	6-TM6879
R20	3.3 kΩ ±10%, 1/2 W	7-TM6879
R21	100 kΩ ±10%, 1/2 W	8-TM6879
R22	47 kΩ ±10%, 1/2 W	3-TM6879
R23	6.8 kΩ ±10%, 1/2 W	9-TM6879
R24	1 kΩ ±10%, 1/2 W	5-TM6879
R25	1 kΩ ±10%, 1/2 W	5-TM6879

TE = Total Excursion.

Component Ref.	Description	Works Ref.
	RESISTORS (continued)	
R26	33 kΩ ±7% TE, 3/8 W	16-TM6879
R27	4.7 kΩ ±7% TE, 3/8 W	11-TM6879
R28	1 kΩ ±10%, 1/2 W	5-TM6879
R29	22 kΩ ±10%, 1/2 W	4-TM6879
R30	82 Ω ±7% TE, 3/8 W	22-TM6879
R31	47 Ω ±10%, 1/2 W	12-TM6879
R32	13 kΩ ±7% TE, 3/8 W/55°C	18-TM6879
R33	1 kΩ ±7% TE, 3/8 W	19-TM6879
R34	15 kΩ ±7% TE, 3/8 W	20-TM6879
R35	1 kΩ ±10%, 1/2 W	5-TM6879
R36	5.6 kΩ ±10%, 1/2 W	13-TM6879
R37	1 kΩ ±10%, 1/2 W	5-TM6879
R38	600 Ω ±1%, 1/4 W	21-TM6879
R39	100 kΩ ±10%, 1/2 W	48-TM6840
R41	3860 Ω ±1/2%, 1/4 W	7-TM7057
R42	3860 Ω ±1/2%, 1/4 W	7-TM 7057
R43	1675 Ω ±1/2 %, 1/4 W	8-TM7057
R44	33 kΩ ±7% TE, 3/8 W	6-TM7057
R45	1 kΩ ±10%, 1/2 W	5-TM6879
R46	100 Ω ±10%, 1/2 W	14-TM6879

TE = Total Excursion.

Component Ref.	Description	Works Ref.
	VARIABLE RESISTORS	
RV1		17-TM6873
RV2A, RV2B, RV2C	10 kΩ ±20%, 1/4 W SET OUTPUT 600 Ω 'T' Pad	51-TM6840
RV3	1 kΩ ±20%, 1/4 W	2-TM7016
RV4	4.7 kΩ ±20%, 1/4 W	3-TM 7016
RV5	1 kΩ ±20%, 1/4 W	2-TM7016
RV6A	10 kΩ ±2%, 4W	
RV6B	10 kΩ ±2%, 4W	52-TM6840
RV6C	5 kΩ ±2%, 4W	
RV7	100 Ω ±10%, 1 W	53-TM6840
RV8	470 Ω ±20%, 1/4 W	2-TM6881
RV9	470 Ω ±20%, 1/4 W	2-TM6881
RV10	470 Ω ±20%, 1/4 W	2-TM6881
RV11	470 Ω ±20%, 1/4 W	2-TM6881
RV12	470 Ω ±20%, 1/4 W	2-TM6881
RV13	470 Ω ±20%, 1/4 W	2-TM6881
RV14	220 kΩ ±20%, 1/4 W	3-TM6881
RV15	220 kΩ ±20%, 1/4 W	3-TM6881
RV16	220 kΩ ±20%, 1/4 W	3-TM6881
RV17	220 kΩ ±20%, 1/4 W	3-TM6881
RV18	220 kΩ ±20%, 1/4 W	3-TM6881
RV19	220 kΩ ±20%, 1/4 W	3-TM6881

Component Ref.	Description	Works Ref.
	SWITCHES	
S1	SUPPLY	22-TM6840
S2	BATTERY/MAINS, Double pole, double throw	64-TM6840
S3	OUTPUT, Single pole, double throw	65-TM6840
S4	RANGE	1-TM7057
	SOCKETS	
SKT1	H.T. OUT	68-TM6840
SKT2	SIG OUT, Miniature Belling-Lee	66-TM6840
	TRANSFORMERS	
T1	Mains	5-TM6840
	THERMISTORS	
TH1	A54	48-TM6879
TH2	CZ3	49-TM6879
	TERMINALS	
TP1	BATTERY +	6-TM6840
TP2	BATTERY -	6-TM6840
TP3	600Ω	6-TM6840
TP4	E	6-TM6840

Component Ref.	Description	Works Ref.
	TRANSISTORS	
VT1	GET111	25-TM6873
VT2	GET111	25-TM6873
VT3	GET111	25-TM6873
VT4	2N1531	59-TM6840
VT5	2S703	39-TM6879
VT6	2S104	40-TM6879
VT7	2S104	40-TM6879
VT8	2S104	40-TM6879
VT9	2S103	41-TM6879
VT10	2N696	42-TM6879
VT11	2N696	42-TM6879

1. COMPONENT VALUES

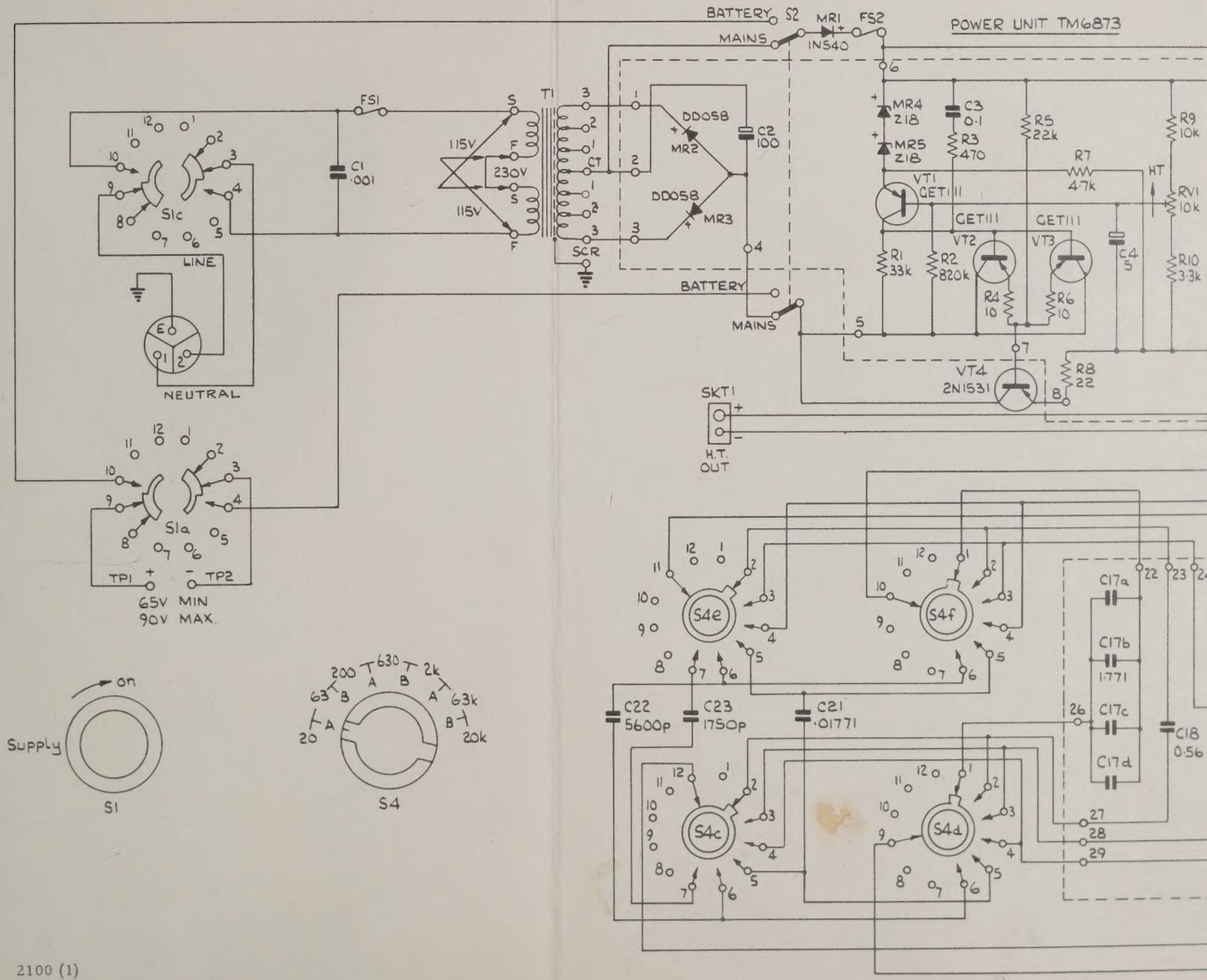
Resistors : No suffix = ohms. k = kilohms. M = megohms.
Capacitors : No suffix = microfarads. p = picofarads.
* value selected during test; nominal value shown.

2. SYMBOLS

arrow indicates clockwise rotation of knob.

3. ROTARY SWITCHES

Drawn as viewed from knob end with switch fully counter-clockwise
a = first section, front
b = first section, rear
c = second section, front
etc.


POWER UNIT TM6873
BATTERY
MAINS
S2
MR1
IN540
FS2
FS1
C1
.001
T1
115V
230V
SCR
DD058
MR2
MR3
C2
100
MR4
Z18
MR5
Z18
C3
0.1
R3
470
R5
22k
R7
4·7k
R9
10k
RV1
10k
HT
VT1
GET111
VT2
VT3
R1
33k
R2
820k
R4
10
R6
10
C4
5
R10
3·3k
VT4
2N1531
R8
22
SKT1
H.T.
OUT
S1c
LINE
NEUTRAL
S1a
TP1
TP2
65V MIN
90V MAX.
S1
Supply
on
S4
S4e
S4f
S4c
S4d
C22
5600p
C23
1750p
C21
·01771
C17a
C17b
1·771
C17c
C17d
C18
0·56

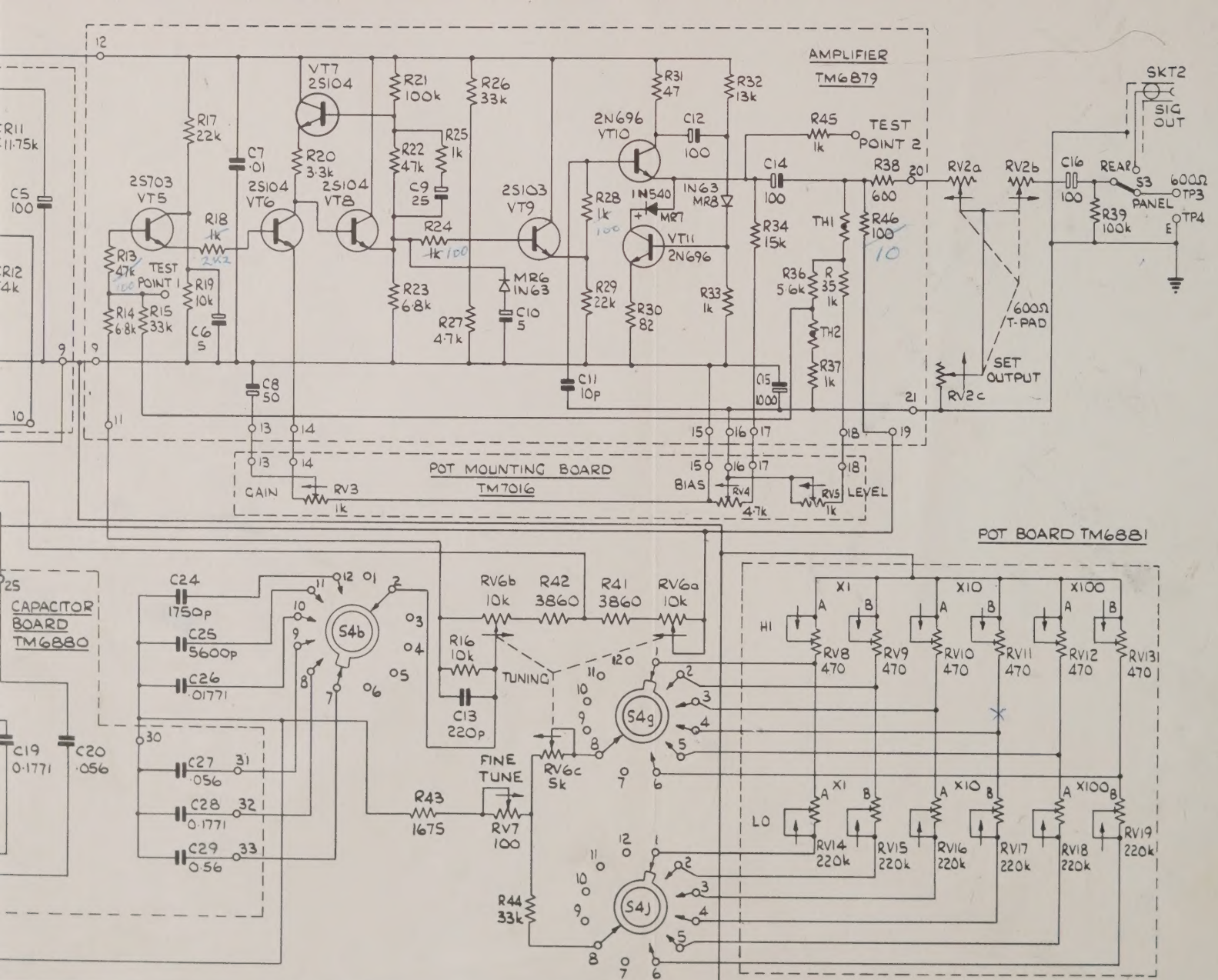


Fig. 4·4 A.F. OSCILLATOR

TF 2100

MARCONI INSTRUMENTS LIMITED

ST. ALBANS, HERTS., ENGLAND

Telephone: ST. ALBANS 59292

Telex: 23350

Service Division *Telephone:* St. Albans 50731

London and the South

ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2

Telephone: COVent Garden 1234 *Telex:* 22572

Midlands (East)

LONGACRES, ST. ALBANS, HERTS.

Telephone: St. Albans 59292 *Telex:* 23350

Midlands (West)

40 WHITELADIES ROAD, BRISTOL, 8.

Telephone: Bristol 39639

North

23-25 STATION SQUARE, HARROGATE

Telephone: Harrogate 67454 *Telex:* 5723

U.S.A.

111 CEDAR LANE, ENGLEWOOD, NEW JERSEY

Telephone: LOwell 7-0607

WORLD-WIDE REPRESENTATION

www.manualsplus.com

1004502

Printed in Great Britain by The Campfield Press, St. Albans